

REMARKS

The application has been amended and is believed to be in condition for allowance.

Claim 11 was indicated to be directed to allowable subject matter.

Claim 12 has been amended to remedy the stated basis of rejection.

Withdrawal of the Section 112, second paragraph rejection is therefore solicited.

Claim 13 has been amended to further recite the laser beam being moved along a plane in which the distance covered by the laser beam in the amplifying medium varies as a function of the latitude of the passage in the amplifying medium. Support for this amendment can be found at least at specification page 9, lines 10-17. No new matter is entered by way of this amendment.

New claim 17 is based on claim 1. New claim 18 is based on allowable claim 11. New claims 19-20 further recite the invention. No new matter is entered by way of these new claims.

Reference is made to the specification beginning with the last two lines of page 9:

With reference to Figure 1, a pumping laser diode 10 emits a laser beam 11 towards a cavity 1 composed of an assembly of three crystals 2, 3 and 4. The amplifying crystal 2 is Nd: YAG. Its output face 7 is cut at the Brewster angle calculated from the index n1 and from the index n2 of the isotropic

crystal 3. The two crystals 2 and 3 are joined to each other on a portion of the face 7.

The isotropic crystal 3 is constituted by potassium tantalate $KTaO_3$ and, on its output face 8, is joined to a frequency-doubling birefringent crystal, the refractive index and the diameter of which are approximately identical to those of the isotropic crystal 3. The two crystals 3 and 4 have colinear geometrical axes. The isotropic crystal 3 is cut at the face 7 so that the laser beam 5 exiting from the Nd: YAG 2 and deflected by the face 7, passes through the crystals 3 and 4 parallel to their geometrical axes.

Art Rejections

Claim 13 was rejected as anticipated by MOORADIAN 5,365,539.

Claims 1, 5-10, and 12 were rejected as obvious over SHICHIJYO 5,809,048 in view of NETTLETON 6,373,865 and DIXON 4,884,276.

Claims 2-4 and 14-16 were rejected in further view of BACHER 7,065,109.

The Claims Are Patentable

With respect for claim 1, SHICHIJYO fairly discloses a light source comprising a semiconductor laser for pumping a laser medium, a birefringence filter and a nonlinear crystal.

The Official Action asserts that SHICHIJYO discloses "a birefringent crystal (4) for frequency doubling (column 15, lines

5-6, and figure 13, label 62); characterized in that it also comprises an isotropic medium (3) inserted between the output face (7) of the amplifying medium and the input face (8) of the birefringent crystal (figure 13, space between 61 and 62)". See Official Action page 3, lines 5-8 from bottom of page.

The Official Action has misunderstood the schematic nature of Figure 13. Reference is made to column 15, lines 6-8 which specifically disclose that "The surface 61b of the laser medium 61 and the surface 62a of the nonlinear optical element 62 contact with each other." Consequently, there can be no isotropic medium inserted between the output face of the amplifying medium and the input face of the birefringent crystal.

The Official Action acknowledges that SHICHIJYO fails to disclose "the amplifying medium (2) and the birefringent crystal (4) being firmly attached to each other so as to constitute a monolithic resonant cavity; and in that the crystalline axis "c" of the birefringent crystal forms an angle θ_c which is not zero with respect to the orthogonal direction of the polarization of the fundamental wave, defined by the Brewster surface." See the last four lines of Official Action page 3.

This recitation requires that the output face (7) of the amplifying medium toward the birefringent material be cut according to the Brewster angle for said fundamental wavelength.

None of the applied references teach this feature.

NETTLETON does disclose a linearly polarized laser in which the gain material is supplied in two components to permit polarized lasing without a separate polarizer. NETTLETON discloses a double Brewster-cut optic endfaces of the gain material. The gain material is composed of the two components and the outface face of this gain material does not have a Brewster cut.

Furthermore, at column 2, lines 54-56, NETTLETON discloses that "This can result in a laser with an optical axis that takes an abrupt turn, basically an undesirable attribute, especially for micro-laser systems." On the contrary, in the present invention, Applicant takes advantage of the Brewster angle in order to obtain an optical axis that takes an abrupt turn. As a matter of fact, the present invention provides an interface between the isotropic medium and the birefringent crystal that is close to the normal. This interposed isotropic medium allows the effects of the double refraction of the birefringent crystal to be limited: in fact, when the angle of incidence tends towards the normal, the angle of the double refraction tends towards zero. It is thus possible to firmly attach the amplifying medium to the birefringent crystal (the doubler) so as to obtain a compact component.

DIXON does not cure the above-noted defects of combining SHICHIJYO and NETTLETON.

Note that NETTLETON aims to "make the laser to operate in a linearly polarized mode".

DIXON discloses a laser device comprising an external cavity. In one embodiment, a blue light radiates along two paths 10 and 12: this is contradiction the aim of linearity expressed by NETTLETON. Thus, DIXON would not modify NETTLETON.

DIXON teaches a C-axis matching with the polarization of the incident radiation from a laser diode. DIXON does not, however, teach:

- an output face of the amplifying medium being cut according to the Brewster angle,

- an isotropic medium inserted between the output face of the amplifying medium and the input face of the birefringent crystal,

- the amplifying medium and the birefringent crystal being firmly attached to each other so as to constitute a monolithic resonant cavity.

For all the foregoing reasons, applicant considers that the combination of SHICHIJYO, NETTLETON and DIXON discloses does not lead to a device as defined in the claims of the present invention. Moreover, applicant considers that, due to contradictions between SHICHIJYO, NETTLETON and DIXON, it would not have been obvious to one of ordinary skill in the art, at the time the invention was made, to consider a combination of the three references.

This amendment is believed to be fully responsive to the pending Official Action.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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